

# Executive Summary

Two utilities, Wisconsin Public Service Corporation (WPSC) and Minnesota Power Company (MP) jointly filed an application in November, 1999 with the Public Service Commission of Wisconsin (Commission or PSCW) for authority to build and operate a high-capacity, 345,000-volt (345 kV) transmission line to connect MP's Arrowhead Substation, near Duluth, Minnesota to WPSC's Weston Substation near Wausau, Wisconsin. The new 345 kV line would be approximately 240 miles in length.

The application also requests authority to construct a 42-mile long 115 kV transmission line from Tripoli, Wisconsin to the Highway 8 Substation in Rhinelander, Wisconsin and a new 345/115 kV substation, located near the village of Tripoli.

In its decision about whether to approve, reject, or modify the applicants' proposal to construct the 345 kV and 115 kV lines, the Commission must determine that the transmission lines are needed to provide an adequate supply of electricity to the public. It must also determine that the construction and operation of the lines and the new substation are in the public interest with respect to design, alternative routes and locations, and alternative sources of supply. Some factors that must be considered by the Commission in its decision include: safety; reliability; individual hardships; and engineering, economic, and environmental factors.

In terms of costs, the high-end cost estimate for the project is \$214 million. This is comprised of \$203 million for the 345 kV Arrowhead-Weston segment and \$11 million for the 115 kV Tripoli-Rhinelander component. With respect to the impact on consumers, construction of the \$214 million project is expected to increase electric rates by 1.2 percent. For a residential customer currently paying \$40 a month, a 1.2 percent increase in the electric bill translates into 48 cents per month or \$5.76 per year. These estimated rate impacts would decline through time as the transmission line becomes fully depreciated.

## Need for the 345 kV Arrowhead-Weston Transmission Project

Under Wis. Stat. § 196.491(3)(d)(2), the Commission must determine that the proposed facilities satisfy the reasonable needs of the public for an adequate supply of electricity. The project applicants state that the 345 kV line is needed to strengthen the bulk transmission system by providing a second high-capacity connection across the Wisconsin-Minnesota transmission interface. Their analyses supporting this statement, based on a number of attributes of the proposed line, are contained in the June, 1999 report of the Wisconsin Reliability Assessment Organization (WRAO) and the application for this project. Commission staff's review of the application examines each of the attributes individually. The broad scope and complexity of the

issues surrounding this proposal will require the Commission to weigh and balance all of the relevant factors in making its final decisions in this case.

Some of the important observations of the Commission staff's analysis of the need for the 345 kV line or additional generation in the state are outlined below.

- Increased transmission transfer capability from the north or west or additional in-state electrical generation could accommodate expected growth in the use of electricity in Wisconsin, as well as the strong historical growth during the 1990s. Electric demand in Wisconsin is expected to grow 2 percent per year through 2007. This compares to a 2.7 percent annual growth during the 1990s. Between 1998 and 2007, statewide electric demand in Wisconsin is expected to grow a total of 2,365 MW, or nearly 300 MW per year. Due to this growth, a no-build policy would lead to significant hardship and substantial economic losses in Wisconsin.
- Between 1995 and 1999, peak-day operating reserves as a percent of peak electric demand have fluctuated between 7 and 14 percent at the statewide level. For the eastern Wisconsin utilities as a group, the range has spanned 4 to 12 percent. In particular years, some eastern utilities have fared worse than the 4 percent lower bound. Operating reserves below 5 percent represent an electric reliability concern.
- Congestion on the transmission system has been limiting economic purchases, translating into a potential need for additional transmission system resources. There have been numerous calls for energy providers to interrupt and cancel power transactions using the state's electric transmission system in recent years. Such calls have become a year-round occurrence, rather than a seasonal one.
- Federal and state policies fostering electric industry restructuring are increasing the usage of the electrical transmission system, fostering a potential need for expanded transmission resources. Policy shifts towards an increased use of competitive market forces at the wholesale level have been implemented to lower electric power production costs, and ultimately reduce electric rates. These measures have created more stress on the ability of the existing regional system to deliver electricity reliably.
- Increased transfer capability could soften or decrease purchased power prices. Constraints on Wisconsin's ability to import power could prevent the flow of lower-cost electric power into the state.
- An expanded transmission system could address prospective horizontal market-power issues in the Wisconsin-Upper Michigan System (WUMS). Presently, when the transmission system becomes constrained or congested, the relevant market size from an anti-trust perspective narrows to the geographic region of WUMS. In essence, a large electric generating firm in a narrow competitive energy market can influence prices to its advantage and everyone else's detriment. In economics, such leverage is referred to as horizontal market power and is policed by federal and state anti-trust laws. One way to reduce such horizontal market power is to eliminate or minimize the extent to which a constrained transmission system is limiting the

import of electric power. This could involve an expansion of the transmission system.

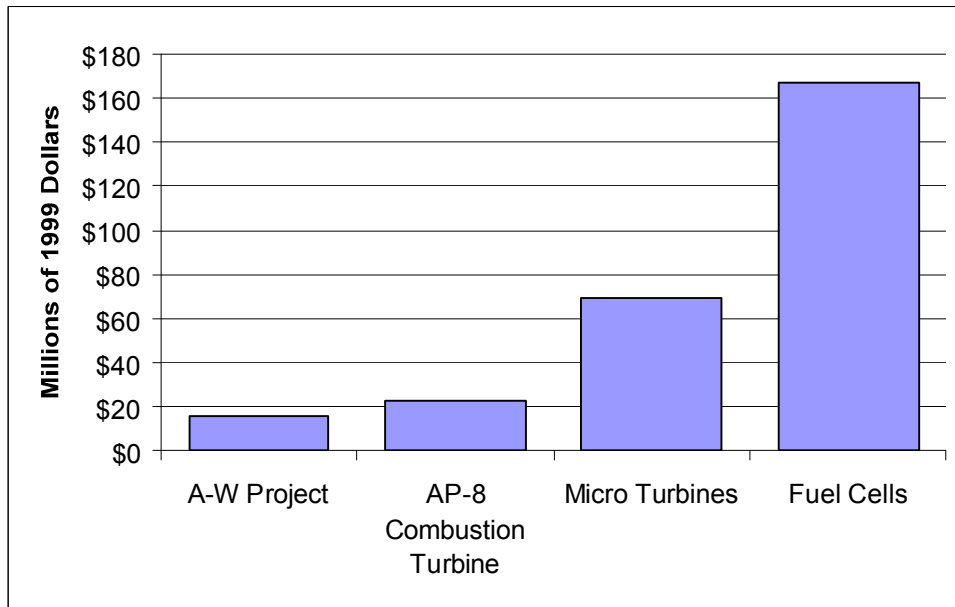
- In general, a 15 percent value has often been used as a guiding estimate of the amount of electricity that Wisconsin imports from outside the state using the state's integrated transmission system. The expected economic growth in Wisconsin during 1998 to 2007 indicates that an additional 360 MW of firm transmission capacity could be required to continue this type of use. In the future, this value will be heavily determined by the economic relationship between purchased power prices and the cost of in-state electric generation.
- An engineering analysis, the Loss-of-Load-Expectation (LOLE) analysis described in Chapter 2, indicates that the need for transmission transfer capability into eastern Wisconsin in the near future is probably somewhere between 730 MW and 2,200 MW. Present-day transmission transfer capability into eastern Wisconsin is approximately 1,000 MW. The 345 kV Arrowhead-Weston line, along with other transmission improvements, would increase transfer capability to at least 3,000 MW.
  - If no new generation were built by 2007, significant transmission improvements to increase transmission transfer capability into Wisconsin would be needed.
  - If new generation were installed at a rate comparable to historical trends over the past 10 years or at a higher rate, the need for increased transmission transfer capability could be greatly reduced. There is a strong probability of this occurring as utilities and independent power producers are planning to add in excess of 3,000 MW of generation capacity in eastern Wisconsin in the next several years.
- Reliance on construction of merchant power plants alone to meet reliability standards may not be wise public policy. Traditionally, a blend of transmission and generation projects and energy efficiency measures have been used to keep up with increases in electric demand arising from economic and population growth.
- The Wisconsin Interface Reliability Enhancement (WIRE) study is the best available source of information on the question of the engineering performance of the proposed line and transmission system alternatives comparable to the proposed line. Several transmission line characteristics are of significance in an engineering evaluation of the proposed line and its alternatives. These include physical aspects related to thermal, voltage and dynamic stability; impacts on power flow across the region; electrical loss savings; and construction costs.
- The proposed line and the six other transmission lines evaluated in the WIRE study were reviewed for this EIS. All of them, with the exception of Salem-Fitchburg, provide roughly comparable transmission benefits. The Lakefield Junction-Columbia line is much longer and more expensive than any other alternative, without providing additional benefits. Accordingly, while the other four lines could be reasonable alternatives to the proposed project, Salem-Fitchburg and Lakefield Junction-Columbia are not.

- Of the remaining lines considered in the WIRE study, some appear to be less expensive than the Arrowhead-Weston line in terms of overall economic impact, and others appear to have a comparable cost.
- Consideration of geographic diversity provides support for locating a new connection between Arrowhead and Weston, since this would be further from existing 345 kV lines than most of the WIRE study alternatives. An analysis by Commission staff confirms that concurrent weather-related outages are more likely for lines that are geographically close together. However, it is difficult to determine how much weight this factor should be given in relation to other factors when evaluating the viability of other transmission line system alternatives.
- A cost comparison of the proposed 345 kV transmission line with non-transmission alternatives indicates, using two different reliability perspectives, that construction of the proposed line and the use of regional purchased power at current market prices may be more cost-effective than relying on rate-based generation alternatives<sup>1</sup> such as combustion turbine or combined-cycle units versus certain renewable resources, including wind turbines and whole-tree biomass, as well as customer-installed distributed resources, including fuel cells and micro turbines. The present value benefit of the line to consumers, relative to combustion turbine operation, could be as high as \$38 million. The figures below reflect the costs to ratepayers or consumers of a one-for-one replacement of the Arrowhead-Weston line under different operating regimes with alternative generation technologies.

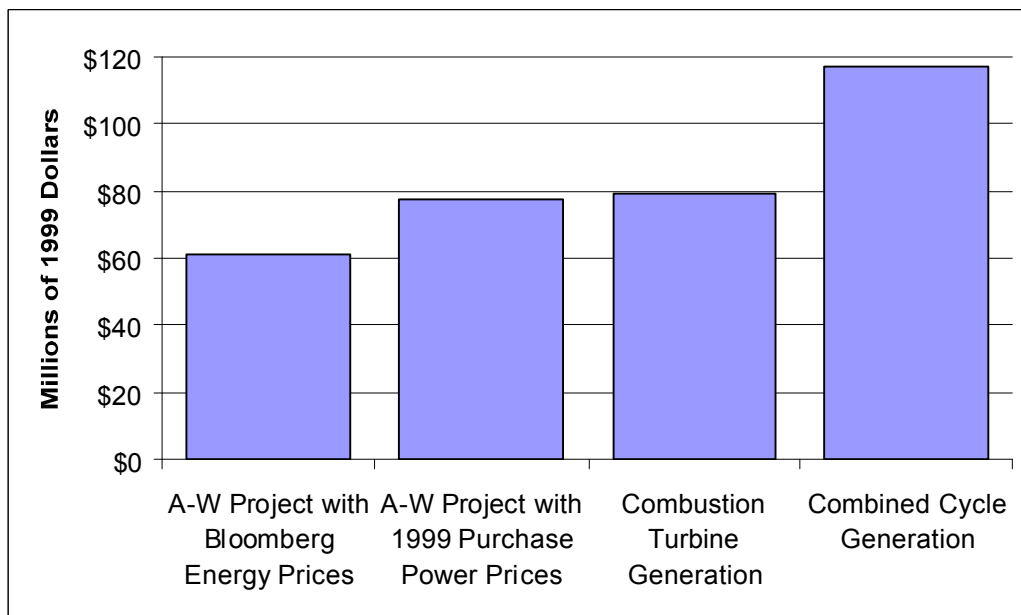
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<sup>1</sup> The cost of merchant power plants is unknown. Therefore, replacement of the proposed transmission line with merchant power plants may or may not be more cost-effective.

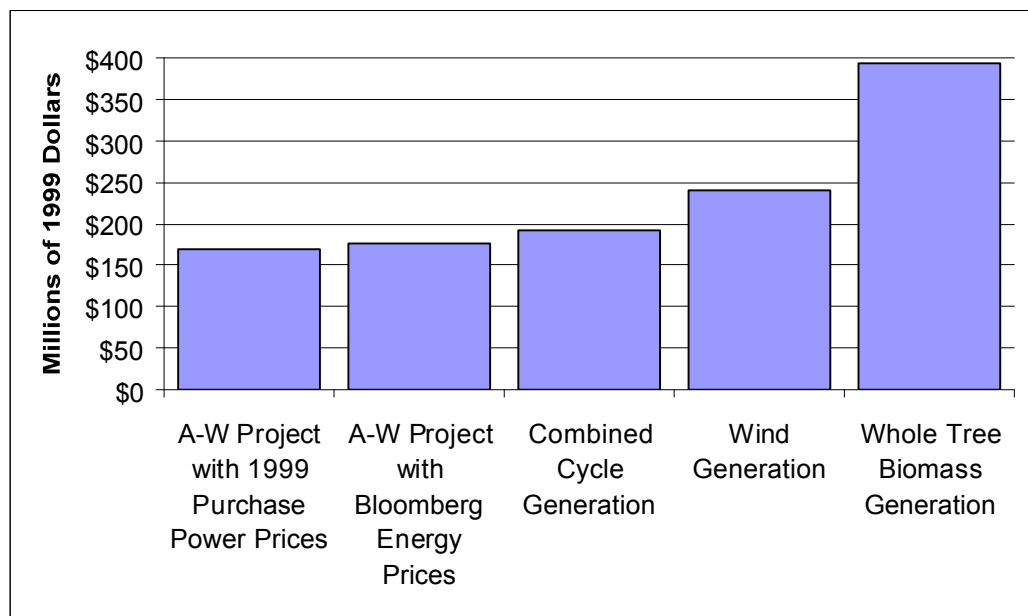
**Figure ES-1     Annual cost to electricity consumers for 790 MW of super-peak-duty service using current purchased power prices**



**Figure ES-2     Annual cost to electricity consumers for 1,470 MW of peaking-duty service using current purchased power prices**



**Figure ES-3     Annual cost to electricity consumers for 1,470 MW of intermediate-duty service using current purchased power prices**



- A cost-sensitivity analysis between the proposed 345 kV transmission line and conventional generation alternatives using forecasted 2010 purchased power prices indicates that construction of the proposed line and the use of regional purchased power could be cost-effective under peaking-duty conditions. However, this is not necessarily the case under intermediate-duty operation.
- It is unlikely that the use of demand-side management and price signals, for managing electric demand and use of the transmission system, would eliminate the need for additional transmission system resources on a one-for-one basis. These alternatives could, however, be used to supplement additional generation capacity in meeting the need for an increased level of reliability.
- It may be possible to meet the need for improvements in Wisconsin's electric power system by means of an integrated alternative to the proposed project, which combines transmission and generation improvements with increased energy efficiency and changes in the way that electricity is priced.
- In order to better assess the potential for an integrated alternative to meet future electricity demand, Commission staff analyzed the improvement in transmission system performance that could be achieved by means of currently planned transmission upgrades (not including the proposed project) and other relatively low-impact transmission improvements. While it did not include a detailed dynamic stability analysis, this assessment indicates that such transmission improvements may be able to increase the ability of the system to transfer power into eastern Wisconsin.

to approximately 2,400 MW. This compares to the proposed project, which could support approximately 3,000 MW of imports into eastern Wisconsin.

- In terms of purchased power availability through 2008, sufficient quantities from MAIN providers are expected. However, in the MAPP region, this will be the case only during non-summer months.
- In terms of job effects, the Arrowhead-Weston project is likely to create 0 to 5 permanent full time jobs in the state. Conventional generation would create between 50 and 80 jobs. The use of renewable resources could create up to 5,380 jobs. These job estimates ignore the transitory job effects of individual project construction.
- Recent utility experience in constructing transmission line projects through landscapes similar in character to the Arrowhead-Weston corridor or through areas requiring large numbers of condemnations (due to substantial public opposition) have resulted in major cost overruns. It is possible that the applicants' estimated costs for the Arrowhead-Weston line may be low, making some of the alternatives more cost-competitive.

## **Environmental analysis of the 345 kV transmission system alternatives**

A system-level analysis is not meant to determine the exact environmental impact caused by a specific transmission line. It is designed to evaluate the relative risk of environmental impact between geographically diverse transmission system options. A study-area approach was used to examine the potential environmental risk to biological resources that could be caused by constructing a high-voltage transmission line. The transmission system alternatives analyzed are: Arrowhead-Weston via Tripoli; Arrowhead-Weston via Owen; Chisago-Weston via Tripoli; Chisago-Weston via Owen; King-Weston South; King-Weston North; Prairie Island-Columbia via Wisconsin; and Prairie Island-Columbia via Minnesota. Salem-Fitchburg and Lakefield Junction-Columbia were not included due to their poor electrical performance.

Eleven factors, that together provide a measure of the environmental quality of the landscapes within each study area, were evaluated. These factors include: land cover, county forest acreage, state properties, state trails, Nationwide Rivers Inventory (NRI), National Scenic Trails (NST), National Scenic Riverways (NSR), Natural Heritage Inventory (NHI) communities, Outstanding and Exceptional Resource Waters (OERW), road densities, and population densities. Socioeconomic factors were also reviewed in a qualitative manner.

- The Arrowhead-Weston via Tripoli system option ranks highest in terms of susceptibility to environmental impact for nine of the eleven environmental factors reviewed. This study area contains the highest number of acres of county forest, the most miles of state trails, the most rivers listed in the NRI, and the most river and shoreline miles of OERW. The potential for forest fragmentation is greatest for this option. It also contains the lowest road and human population densities. These

factors indicate an area largely dominated by natural landscape features that could be seriously harmed by the construction of a major high-voltage transmission line.

- The King-Weston South system options rank the lowest in terms of susceptibility to impacts on natural resources. It contains the lowest percentage of land cover in wetland and forest, the fewest acres of state properties, the fewest NST, the lowest number of shoreline miles of OERW, the fewest rivers listed in the NRI, and the lowest potential for forest fragmentation. Conversely, this study area has the highest road densities and the highest percentage of land cover devoted to commercial, agriculture, and/or residential development. Because of these factors and higher human population densities, the construction of a line in this area could result in greater public visibility of the line and an increased level of concern regarding noise, property values, and health and safety issues.

## **Environmental analysis of proposed routes for the 345 kV Arrowhead-Weston line**

The project area for the 345 kV Arrowhead-Weston Transmission Project is divided into three route sectors. The Oliver Sector contains three alternative routes. The Tripoli and Owen Sectors each contain four alternative routes.

- The Oliver Sector extends from the Minnesota-Wisconsin border at the St. Louis River to Exeland.
- The Tripoli Sector extends from Exeland to Weston by way of Tripoli.
- The Owen Sector extends from Exeland to Weston by way of Owen-Withee.

If the 345 kV line is approved, a route would be selected from among the possible routes in the Oliver Sector to reach the area near Exeland. The Commission would decide whether to use the Owen Sector or the Tripoli Sector to proceed from Exeland to Weston, and a route would then be selected in that sector to reach the Weston Substation.

The applicants proposed a variety of line designs that could be used to construct the 345 kV line. These designs include different pole types (H-frame or single pole) and different construction methods where the route follows an existing transmission line corridor (double circuit or parallel construction). Double circuiting involves placing the existing line and the new line on the same structures, thereby minimizing the amount of ROW needed. Parallel construction would place the new 345 kV line adjacent to the existing line on a separate structure. While a portion of the ROWs could be overlapped, side-by-side lines would require much more new ROW (about 90 feet) than a double circuit line (about 20 feet).

Commission staff conducted detailed environmental analyses of the proposed routes in each sector. The major environmental concerns and effects in each sector are highlighted below.



## **Oliver Sector**

The Oliver 1, 2, and 3 Routes are all similar in length, varying from nearly 92 miles to 99 miles. The Oliver 1 Route is designed to maximize corridor-sharing opportunities, whereas the Oliver 2 Route is designed to avoid exposure to human development. Approximately half of the length of the Oliver 2 Route would require creation of an entirely new ROW through areas where no other existing infrastructure (roads, pipelines, railroads, or electric transmission lines) is present. The Oliver 3 Route is designed to merge some of the environmental advantages of the Oliver 1 and 2 Routes, while offering an additional opportunity to use an existing transmission line ROW through a portion of the Lac Courte Oreilles Reservation in Sawyer County. Use of this route may require permission from the tribe to place the line on reservation lands.

Fragmentation of large upland and wetland forests is a serious environmental effect of the Oliver 2 Route. Construction of the 345 kV line on the Oliver 2 Route would fragment at least eight large forest blocks greater than 1,000 acres in size. While some fragmentation is possible on the Oliver 1 Route, the Oliver 3 Route would not require creation of any new corridor through large forest blocks.

All of the Oliver Routes pass through relatively remote areas and accessibility for construction across wetlands and streams is a major concern for all of the routes. This lack of accessibility poses the greatest potential for degradation of wetland function and aquatic habitats. Several of the rivers have extremely steep banks consisting of highly erodible clay soils. The Oliver 2 Route crosses the most wetlands and streams where access would be a problem. All of the routes cross the St. Croix River near St. Croix Lake and the Namekagon River near Hayward. The Namekagon River is part of the St. Croix National Scenic Riverway, which is managed by the National Park Service.

Each of the routes affect several unique and special resources including, but not limited to: the St. Croix National Scenic Riverway, the North Country Trail and Historic Portage Trail, the Totogatic River with associated muskeg wetlands, springs and headwaters of remote high-quality wetlands, and many Class I trout streams.

## **Tripoli Sector**

The four routes in the Tripoli Sector are very similar in length, ranging from 131 miles to 138 miles. None of the routes share a corridor with existing infrastructure for more than a third of their length.

Forest fragmentation is a very serious concern on all of the Tripoli Routes. Many areas affected by the routes are densely forested, with only scattered residential development. On several of the routes, the proposed line would bisect more than 20 forest blocks larger than 1,000 acres in size.

Limited access to construct the new line across many wetlands and streams is also a significant environmental concern in the Tripoli Sector due to a scarcity of roads and corridor-sharing

opportunities along the routes. All of the routes would cross the Flambeau River. The Tripoli 2 Route would cross the river at a location within the Flambeau River State Forest that has been designated a wilderness area.

Each of the routes crosses the Ice Age National Scenic Trail, the Knox Creek Heritage Center Trail, and the Nine Mile Unit of the Marathon County Forest (Nine Mile Forest), which is heavily used for hiking, cross-country skiing, mountain biking, and other purposes.

## **Owen Sector**

The four routes in the Owen Sector are similar in length; they are, on average, 15 percent shorter than the routes in the Tripoli Sector. Approximately 40 to 70 percent of each of these routes share a corridor with some type of existing infrastructure and all require about the same amount of new ROW.

These routes are quite similar in character. All routes are primarily in an agricultural landscape, but do pass through some large forested areas in Rusk County. Impacts on farm operations could be an important concern on these routes.

Again, all of the routes would cross the Nine Mile Forest as they approach the Weston Substation. The Owen 2, Owen 3, and Owen 4 Routes would also cross property owned by the Flambeau Mining Company that is open for public recreation. As they pass through this property, the routes cross the Flambeau River using an existing pipeline corridor crossing where there is public access to the river.

The potential for forest fragmentation is lower in this sector because of smaller forest block size and less forest cover. However, ROW clearing through many of the smaller remaining forested tracts could also have adverse effects on habitat for woodland species.

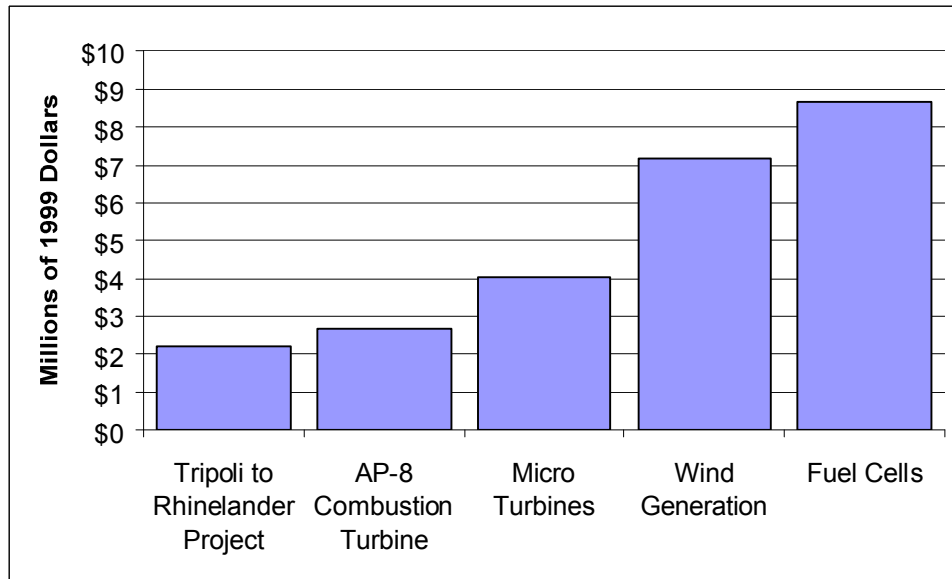
The Owen Routes cross much more farmland than the routes in either the Oliver or Tripoli Sectors. The potential for interference with farming operations and concerns about induced currents and stray voltage issues would be more prevalent in this sector than anywhere else in the project area.

## **Need for the 115 kV Tripoli-Rhineland transmission line**

The new Tripoli Substation and the 115 kV transmission line are proposed to provide local load serving support and alleviate transmission system problems in WPSC's "Upper West" area near Rhineland. The applicants state that growth in peak electric demand in the area indicates that about 40 MW of additional capacity will be needed by 2010. This load growth projection is consistent with electric demand forecasts made in the most recent Advance Plan. Commission staff evaluated the proposed project and potential transmission and non-transmission alternatives to the Tripoli-Rhineland line.

- The cost of replacing the line with rate-based generation, such as a small combustion turbine, micro turbines, wind generation, and fuel cells was analyzed. The total annual cost is less for the proposed Tripoli-Rhineland project than for any other non-transmission alternative. The difference in cost, however, is less than \$0.5 million for a small combustion turbine and less than \$2 million for micro turbines.

**Figure ES-4 Annual cost to electricity consumers for 40 MW of peaking-duty service using current purchased power prices**



- Alternative transmission solutions analyzed include one or more of the following: reconductoring an existing transmission line; adding one or more new 115 kV transmission line circuits between existing substations in the project area; or building a new 345/115 kV substation and a 115 kV transmission line in a new right-of-way. The cost of all of these alternatives is roughly comparable; however, the electrical performance of the Tripoli-Rhineland 115 kV line is the best of all alternatives considered. This line and the Prentice-Rhineland 115 kV option would require an interconnection with a major high-voltage transmission line.

## **Environmental analysis of the 115 kV transmission system alternatives**

A study area approach was also used to examine the three system alternatives to the proposed 115 kV Tripoli-Rhineland transmission line. The system alternatives are: Prentice-Rhineland; Black Brook-Venus; and the Parallel Circuit Plan. The latter two alternatives would involve adding a new 115 kV circuit within existing transmission line corridors, while Prentice-Rhineland would involve construction of a new 115 kV line in a new transmission line

corridor. Five environmental factors were analyzed including land cover, public lands, water body crossings, corridor sharing opportunities, and population densities.

- The Parallel Circuit Plan would result in the fewest miles of transmission construction and the least amount of new ROW disturbance. The Prentice-Rhineland system option passes through or nearby more urban areas than the other options and lies within a corridor that is a major tourism and recreation destination. Construction of a new 115 kV line through this area could raise substantial concerns about human and socioeconomic impacts.

## **Environmental analysis of the proposed routes for the 115 kV Tripoli-Rhineland line**

The Rhineland Sector (for the proposed 115 kV Tripoli-Rhineland transmission line) is divided into two sections, one east of US Highway 51 (USH 51) and another west of USH 51. Each section contains three primary routes.

- West of USH 51, the Central Route and the North Route follow the same path for several miles before diverging and taking different paths around several lakes and the community of Heafford Junction near USH 51. The Central Route passes through a heavy concentration of lakes as it parallels USH 8 eastward. The North Route cuts into a dense forested area to avoid the lakes, requiring more forest clearing than either of the other routes. The South Route is a mixture of cross-country and corridor sharing segments. It passes through portions of the Lincoln County Forest where forest fragmentation is a major concern. Further to the east, this route enters the north end of the city of Tomahawk as it continues to USH 51.
- East of USH 51, all routes have opportunities to share ROW with roads, a railroad, a pipeline, and a transmission line. The Railroad and Highway 8 Routes share a ROW with existing infrastructure (road, railroad, pipeline, or transmission line) for nearly their entire length. The Cross Country Route would require development of a new 80-foot wide ROW through several miles of dense forest cover. It crosses the Treehaven property, an environmental research and education center, owned and managed by the University of Wisconsin-Stevens Point Foundation.
- Because of more corridor sharing opportunities, accessibility to wetlands and streams is less problematic in the Rhineland Sector than in other sectors of this project.